WHAT WE CLAIM:

1. A polyanionic polymer conjugate of the formula:

$$L\text{-}O\text{-}[\ PO_2\text{-}O\text{-}Z\text{-}O]_n\text{-}PO_2\text{-}O\text{-}X$$

wherein n ranges from 1 to 200; L represents a moiety comprising a functional group for attaching the polyanion polymer to a nanoparticle surface; Z represents a bridging group, and X represents Q, X' or -Q-X', wherein Q represents a functional group for attaching a recognition probe to the polyanion polymer, and X' represents a recognition probe.

2. The polyanionic polymer conjugate of claim 1, wherein the polyanion polymer further comprises a detection label bound thereto.

3. The polyanionic polymer conjugate of claim 2, wherein the detection label comprises a chromophore, a fluorescent label, a UV label, a radioisotope, a Raman label or a SERS (surface enhanced raman spectroscopy) label, or an enzyme.

4. The polyanionic polymer conjugate of claim 1, wherein the functional group for attaching a recognition probe to the polyanion polymer comprises a carboxylic acid or an amino group.

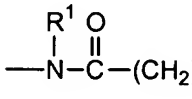
5. The polyanionic polymer conjugate of claim 1, wherein the recognition probe comprises a protein, a peptide, a nucleic acid, a peptide nucleic acid, a linked nucleic acid, a nucleoside triphosphate, a carbohydrate, a lipid, a lipid bound protein, an aptamer, a virus, a cell fragment, or a whole cell.

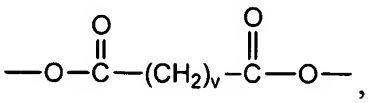
6. The polyanionic polymer conjugate of claim 5, wherein the lipid bound protein comprises a G-protein coupled receptor.

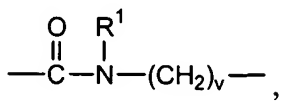
7. The polyanionic polymer conjugate of claim 1, wherein the recognition probe comprises an antibody, an antigen, a receptor, or a ligand.

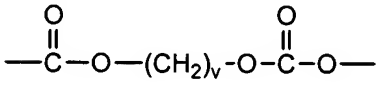
8. The polyanionic polymer conjugate of claim 1 wherein L comprises an alkanethiol contaning group, a phosphorothioate contaning group, a substituted alkylsiloxane containing, a polythiol containing group, or a cyclic disulfide containing group.

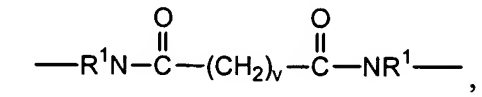
9. The polyanionic polymer conjugate of claim 1 wherein Z comprises a polymer, $-C_1-C_{10}$-alkyl-, -COO-, $-CH_2(CH_2)_vCOO-$, -OCO-, $R^1N(CH_2)_v-NR^1-$, $-OC(CH_2)_v-$, $-(CH_2)_v-$, $-O-(CH_2)_v-O-$, $-R^1N-(CH_2)_v-$,

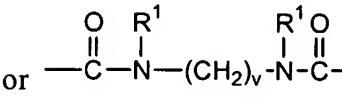










or  , v is 0-30 and R^1 is H or is $G(CH_2)_v$, wherein G is $-CH_3$, $-CHCH_3$, -COOH, $-CO_2(CH_2)_vCH_3$, -OH, or $-CH_2OH$.

10. A nanoparticle having a plurality of polyanionic polymer conjugates of claim 1 attached thereto.

11. The nanoparticle of claim 10, wherein the polyanionic polymer conjugate further comprises a detection label bound thereto.

12. The nanoparticle of claim 11, wherein the detection label comprises a chromophore, a fluorescent label, a UV label, a radioisotope, a Raman label or a SERS (surface enhanced raman spectroscopy) label, or an enzyme.

13. The nanoparticle of claim 10, wherein the functional group for attaching a probe to the polyanionic polymer conjugate comprises a carboxylic acid or an amino group.

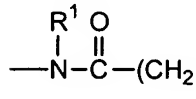
14. The nanoparticle of claim 10, wherein the recognition probe comprises a protein, a peptide, a nucleic acid, a peptide nucleic acid, a linked nucleic acid, a nucleoside triphosphate, a carbohydrate, a lipid, a lipid bound protein, an aptamer, a virus, a cell fragment, or a whole cell.

15. The nanoparticle of claim 14, wherein the lipid bound protein comprises a G-protein coupled receptor.

16. The nanoparticle of claim 10, wherein the recognition probe comprises an antibody, an antigen, a receptor, or a ligand.

17. The nanoparticle of claim 10 wherein L comprises an alkanethiol containing group, a phosphorothioate containing group, a substituted alkylsiloxane containing, a polythiol containing group, or a cyclic disulfide containing group.

18. The nanoparticle of claim 10 wherein Z comprises a polymer, -C_1-C_{10}-alkyl-, -COO-, -$CH_2(CH_2)_vCOO$-, -OCO-, $R^1N(CH_2)_v$-NR^1-, -$OC(CH_2)_v$-, -$(CH_2)_v$-, -O-$(CH_2)_v$-O-, -R^1N-$(CH_2)_v$-,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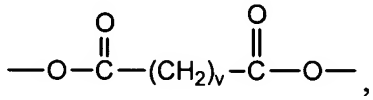
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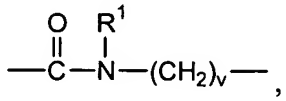
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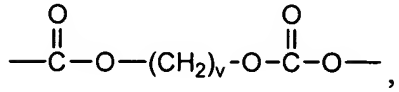
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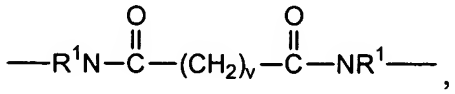
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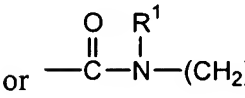
or 
, v is 0-30 and R^1 is H or is $G(CH_2)_v$, wherein G is $-CH_3$, -$CHCH_3$, -COOH, -$CO_2(CH_2)_vCH_3$, -OH, or -CH_2OH.

19. A method for detecting the presence or absence of a target analyte in a sample comprising:

providing nanoparticles having a plurality of polyanionic polymer conjugates of claim 1 attached thereto, wherein the recognition probes bound to the polyanionic polymer conjugates selectively bind to the target analyte;

contacting the nanoparticles with the sample under conditions effective to allow for binding of the recognition probes with the target analyte; and

observing a detectable change brought by the binding of the recognition probes with the target analyte.

20. The method according to claim 19 wherein the recognition probe bound to the polyanionic polymer conjugate comprises a protein, a peptide, a nucleic acid, a peptide nucleic acid, a linked nucleic acid, a nucleoside triphosphate, a carbohydrate, a lipid, a lipid bound protein, an aptamer, a virus, a cell fragment, or a whole cell.

21. The method according to claim 19 wherein the lipid bound protein comprises a G-protein coupled receptor.

22. The method according to claim 19 wherein the recognition probe comprises an antibody, an antigen, a receptor, or a ligand.

23. The method according to claim 19 wherein detection label comprises a chromophore, a fluorescent label, a UV label, a radioisotope, a Raman label or a SERS (surface enhanced raman spectroscopy) label, or an enzyme.

24. The method according to claim 19 wherein the detectable change is a change in color.

25. The method according to claim 19 wherein the detectable change is an optical change associated with nanoparticle binding of the target.

26. A method for detecting the presence or absence of one or more target analytes in a sample comprising:

providing one or more types of nanoparticles having a plurality of polyanionic polymer conjugates of claim 1 attached thereto, wherein the polyanionic polymer conjugate attached to each type of nanoparticles has bound thereto a recognition probe specific for a target analyte and a detection label that serves as an identifer for a specific target analyte;

contacting the nanoparticles with the sample under conditions effective to allow for binding of the recognition probes and the target analytes; and

observing detectable changes for each analyte brought by the binding of the recognition probe with the target analyte.

27. The method according to claim 26 wherein the recognition probe bound to the polyanionic polymer conjugate comprises a protein, a peptide, a nucleic acid, a peptide nucleic acid, a linked nucleic acid, a nucleoside triphosphate, a carbohydrate, a lipid, a lipid bound protein, an aptamer, a virus, a cell fragment, or a whole cell.

28. The method according to claim 26 wherein the lipid bound protein comprises a G-protein coupled receptor.

29. The method according to claim 26 wherein the recognition probe comprises an antibody, an antigen,a receptor, or a ligand.

30. The method according to claim 26 wherein detection label comprises a chromophore, a fluorescent label, a UV label, a radioisotope, a Raman label or a SERS (surface enhanced raman spectroscopy) label, or an enzyme.

31. The method according to claim 26 wherein the detectable change is a change in color.

32. The method according to claim 26 wherein the detectable change is an optical change associated with nanoparticle binding of the target.

33. A method for detecting for the presence or absence of one or more target analytes in a sample, the target analyte having at least two binding sites, said method comprising:

providing a substrate having bound thereto one or more types of capture probes for immobilizing the target analyte onto said substrate, each capture probe specific for a target analyte;

providing one or more types of nanoparticles having a plurality of polyanionic polymer conjugates attached thereto, wherein the polyanionic polymer conjugates attached to each type of nanoparticles has bound thereto (i) a recognition probe specific for a target analyte and (ii) a detection label that serves as an identifer for a specific target analyte;

contacting the nanoparticles, the sample, and the substrate under conditions effective for specific binding interactions between the target analyte, the capture probe, and the nanoparticle so as to form a detection substrate having nanoparticles complexed thereto in the presence of one or more target analytes in the sample; and

determining for the presence of said complexes on said detection substrate as an indication of the presence of one or more target analytes in the sample.

34. The method of claim 33, wherein the substrate has a plurality of different capture probes attached thereto in an array to allow for the detection of multiple types of target analytes.

35. The method of claim 33, wherein the substrate comprises a glass slide, a microplate well, or glass beads.

36. The method according to claim 33 wherein the recognition probe bound to the polymer comprises a protein, a peptide, a nucleic acid, a peptide nucleic acid, a

linked nucleic acid, a nucleoside triphosphate, a carbohydrate, a lipid, a lipid bound protein, an aptamer, a virus, a cell fragment, or a whole cell.

37. The method according to claim 33 wherein the recognition probe bound to the polyanionic polymer conjugate comprises a protein, a peptide, a nucleic acid, a peptide nucleic acid, a linked nucleic acid, a nucleoside triphosphate, a carbohydrate, a lipid, a lipid bound protein, an aptamer, a virus, a cell fragment, or a whole cell.

38. The method according to claim 33 wherein the lipid bound protein comprises a G-protein coupled receptor.

39. The method according to claim 33 wherein the recognition probe comprises an antibody, an antigen, a receptor, or a ligand.

40. The method according to claim 33 wherein detection label comprises a chromophore, a fluorescent label, a UV label, a radioisotope, a Raman label or a SERS (surface enhanced raman spectroscopy) label, or an enzyme.

41. The method according to claim 33 wherein the detectable change is a change in color.

42. The method according to claim 33 wherein the detectable change is an optical change associated with nanoparticle binding of the target.

43. A kit for detecting the presence or absence of a target analyte in a sample comprising:

(a) nanoparticles having polyanionic polymer conjugates bound thereto, wherein the polyanion polymers have the formula:

$$L\text{-}O\text{-}[\,PO_2\text{-}O\text{-}Z\text{-}O]_n\text{-}PO_2\text{-}O\text{-}X$$

wherein n ranges from 1 to 200; L represents a moiety comprising a functional group for attaching the polyanion polymer to a nanoparticle surface; Z represents a bridging

group, and X represents Q, X' or -Q-X', wherein Q represents a functional group for attaching a probe to the polyanion polymer, and X' represents a probe; and

(b) an optional substrate for observing a detectable change.

44. The kit of claim 43, wherein the polyanionic polymer conjugate further comprises a detection label bound thereto.

45. The kit of claim 44, wherein the detection label comprises a chromophore, a fluorescent label, a UV label, a radioisotope, a Raman label or a SERS (surface enhanced raman spectroscopy) label, or an enzyme.

46. The kit of claim 43, wherein the functional group for attaching a probe to the polyanionic polymer conjugate comprises a carboxylic acid or an amino group.

47. The kit of claim 43, wherein the probe comprises a protein, a peptide, a nucleic acid, a peptide nucleic acid, a linked nucleic acid, a nucleoside triphosphate, a carbohydrate, a lipid, a lipid bound protein, an aptamer, a virus, a cell fragment, or a whole cell.

48. The kit of claim 47, wherein the lipid bound protein comprises a G-protein coupled receptor.

49. The kit of claim 43, wherein the probe comprises an antibody, an antigen, a receptor, or a ligand.

50. The kit of claim 43 wherein the substrate is a transparent substrate or an opaque white substrate.